



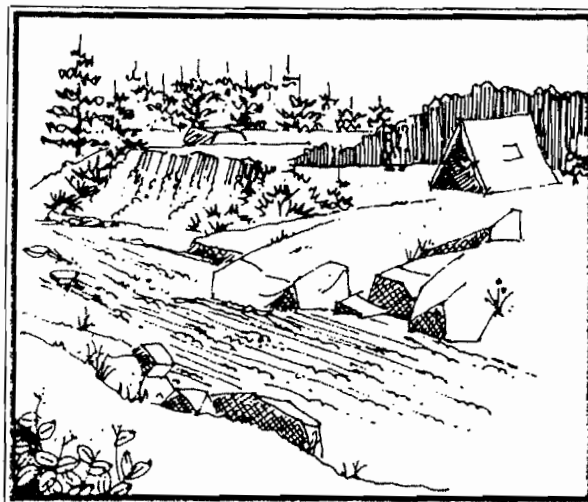
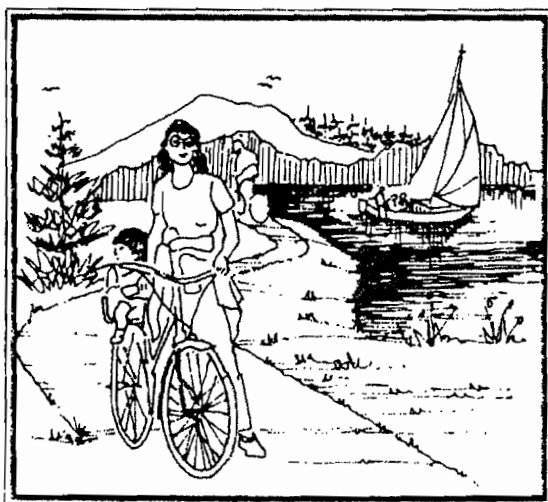
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# Proceedings of the 1992 Northeastern Recreation Research Symposium

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## **NORTHEASTERN RECREATION RESEARCH MEETING POLICY STATEMENT**

The Northeastern Recreation Research meeting seeks to foster quality information exchange between recreation and travel resource managers and researchers throughout the Northeast. The forum provides opportunities for managers from different agencies and states, and from different governmental levels, to discuss current issues and problems in the field. Students and all those interested in continuing education in recreation and travel resource management are particularly welcome.

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# **PROCEEDINGS of the 1992 NORTHEASTERN RECREATION RESEARCH SYMPOSIUM**

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**State Parks Management and Research Institute  
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# TRAIL INVENTORY AND ASSESSMENT APPROACHES APPLIED TO TRAIL SYSTEM PLANNING AT DELAWARE WATER GAP NATIONAL RECREATION AREA

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Trail system planning and management require accurate assessments of existing trail resources and their condition. A standardized and efficient process for surveying, inventorying, and assessing trail systems was developed and applied in the Delaware Water Gap National Recreation Area. Two approaches employed were (1) a Trail System Inventory, and (2) Prescriptive Work Logs. These complementary approaches provide resource managers with valuable information regarding the location and length of individual trails, their current condition and needed maintenance work, and material and labor estimates necessary to conduct such work.

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## Introduction

This paper describes two trail inventory and assessment approaches developed and applied at Delaware Water Gap National Recreation Area (DWGNRA) in support of a comprehensive trail planning effort. The trail surveys and final report were developed by the Appalachian Mountain Club (AMC) Trails Program under cooperative agreement with the National Park Service (NPS)<sup>1</sup>. Here, we review the criteria used to select the specific trail survey approaches, discuss our application of these approaches, and critique the capabilities and limitations of the approaches. We believe the standardized, yet flexible, techniques applied in DWGNRA offer significant advancement over earlier, less structured approaches.

## Trail System Planning in DWGNRA

The objective of natural resource management planning is to translate legislation, regulations, and policies into objectives, programs, and specific actions (Hendee and von Koch 1990). The trail system planning strategy for DWGNRA mirrored this process by translating DWGNRA General Management Plan (GMP) goals into specific trail resource

recreation alternatives for visitors. To meet the needs of resource visitors and resource managers, the strategy for DWGNRA included: (1) identification of recreation interests, (2) identification of management objectives, (3) documentation of trail resources, and (4) prescriptions for correcting resource problems in light of recreation interest and management concerns. To be effective, this plan had to be flexible by design in order to address both current and future trail resource needs.

Approaches to trail system planning are selected according to management objectives, often derived with cooperative involvement of interested and involved individuals and organizations. The process adopted here is marked by the cooperation of an external organization in analyzing the suitability of trails to address recreation demands and concerns. The results of this effort are intended to feed a public review process.

## Project Background

DWGNRA is managed by the NPS and is located in the states of Pennsylvania and New Jersey. Established along a 35 mile stretch of the Delaware River by an Act of Congress in 1965 as part of the Tocks Island hydroelectric project, DWGNRA today embraces some 54,000 acres of the nearly 70,000 acres originally circumscribed. Congress, as part of the Tocks Island Dam legislation, directed the Army Corp of Engineers to assemble a detailed set of maps for the area within the congressionally mandated boundaries. These cartographic documents provided a rich resource for this project. The 1987 DWGNRA GMP called for the enhancement of day and overnight hiking opportunities, to be accomplished with the provision of an expanded trails network. The GMP specifically obligated DWGNRA to work with trail clubs and organizations in planning for expanding and maintaining the trail system. The AMC, though headquartered in Boston, met the NPS needs as a conservation and recreation organization with an organizational chapter located in the DWGNRA region. In 1975, the AMC had performed a study under cooperative agreement with DWGNRA (Appalachian Mountain Club). More significantly, in 1988 the AMC had completed a park-wide trail study for Acadia National Park in Maine<sup>2</sup>. In 1989 DWGNRA invited the AMC to complete a similar study of their trails.

## Primary Goals of the Project

DWGNRA faced a situation common to many parks and forests: how to upgrade an existing, partially informal trail system in an organized manner when both the current conditions and viable options for improving the system are incompletely documented. DWGNRA intended to offer a trail system with a diversity of dispersed recreation opportunities, but required information to direct the necessary efforts in a cost-effective manner.

The primary goals of this project, then, were to:

1. Emphasize the protection of the existing and proposed trail system resources by identifying deficiencies, alternative engineering solutions, and visitor management actions.
2. Produce a report for DWGNRA containing documentation of the trail system's current status, options for future alignment, and estimated costs required to realize potential alignments. This report was intended to provide a preliminary set of recommendations for the comprehensive trail planning process.
3. Incorporate the objectives of the DWGNRA GMP wherever possible, especially those to: (a) provide a quality trail system that emphasizes a minimal disruption of natural processes while servicing a broad range of visitors, and (b) employ existing dirt roads, trails, and woods roads to the greatest advantage.

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1/ Williams, Peter B.; Marion, J.L.; Rajala, R.R. 1992. A comprehensive trail inventory and preliminary recommendations for development and maintenance of a trail system in Delaware Water Gap National Recreation Area. Gorham, NH: Appalachian Mountain Club, Trails Program. 93 p. [unpublished].

2/ Williams, Peter B.; Rajala, R.R.; Martin, B.H. 1988. Acadia National Park trail system assessment. Gorham, NH: Appalachian Mountain Club, Trails Program. 69 p. [unpublished].

### Selection of Inventory and Assessment Approaches

The cooperative agreement between DWGNRA and the AMC addressed the need to document existing conditions through a comprehensive trail resource inventory and assessment. The purpose for the report was to fuel a public review period, to provide a starting point for comments by managers and interested members of the public. To achieve these ends, two state-of-the-knowledge techniques for trail inventory and assessment were applied: (1) a *Trail System Inventory* and (2) *Prescriptive Trail Work Log* assessments.

Four techniques were considered (Table 1). Each approach has its own unique capabilities. Of the techniques applied in DWGNRA, a *Trail System Inventory* approach provides a broad description of the system as a whole, including the location, classification, and general features of individual trails. The *Prescriptive Work Log* approach, in contrast, catalogs specific features of a trail. Groups of trails may then be reviewed

according to their features or deficiencies (e.g.: drainage needed in a local area, district, park, or forest). Originally, prescriptive work logs served trail maintenance purposes. The location of existing trail engineering features were catalogued along with any work needed to maintain those features. A modern prescriptive work log, however, fulfills management, as well as maintenance, objectives. Contents of prescriptive work logs completed in DWGNRA consist of observations oriented toward maintenance and management of the trail resource, oftentimes coupled with references to selected visitor management and recreation features (e.g.: viewsheds, camping potential, general parking availability). Such techniques can be modified according to a manager's need to obtain information for a variety of purposes, including maintenance, visitor interpretation, natural resource protection, or any combination. The information gathered by each of the two techniques selected for application in DWGNRA, then, was intended to complement the information gathered by the other.

Table 1. Four trail inventory and assessment techniques.

| Technique                     | Purpose   |
|-------------------------------|---|
| Trail (System) Inventory      | Identify and catalog the trail system's physical resources including surface type, location, or access opportunities. Often incorporates non-physical classifications such as ownership, type of use, or maintenance level. |
| Prescriptive Trail Work Logs  | Identify trail tread deficiencies and prescribe tread engineering solutions. Adaptable to resource and visitor management purposes. Provides basis for cost and staff estimates and recommendations.                        |
| Research Level Measurements   | Studies designed to understand processes such as relationships between visitation and resource degradation.   |
| Monitoring Level Measurements | Monitoring resource conditions over time. Oriented toward measuring parameters documenting resource impacts rather than resource maintenance and management.  |

### Monitoring and Work Log Approaches Compared

Of the four approaches outlined in Table 1, heaviest debate focused on whether to apply monitoring or prescriptive work log techniques to support the anticipated report's recommendations. Monitoring is done to measure physical changes to the environment resulting from an influential factor, typically recreational use. For example, soil loss occurring over a period of time may be measured. While monitoring might provide objective assessments of trail resource conditions, such measurements do not provide the information necessary to estimate the cost for repairing the effects or mitigating the cause of resource degradation. Yet, estimating these costs was an important management objective for the project. Further, monitoring is not intended to prescribe recommendations for addressing concerns about the resource or visitors, a primary goal of the cooperative agreement.

For this project, a monitoring effort would have yielded a description of the changes occurring as a result of recreation. A prescriptive work log approach, however, would yield a description of the recommended solutions to such physical changes. One final factor was considered: trail maintenance recommendations will vary according to the type and amount of existing or anticipated recreational use. In many ways, trail work is discretionary by its very nature; those who work on trails must make judgments concerning how best to remedy a perceived problem. The need for flexibility in describing trail maintenance recommendations became the crucial criteria for selecting an approach. Because prescriptive work logs originally were devised to document recommendations based on direct field observations, they are most easily adapted to provide information necessary for estimating costs.

### Trail System Inventory: Methodology

Three objectives of equal priority guided the trail system inventory. First, the twenty-five year old Army Corps of Engineers maps required ground verification of all trails and

roads features. Second, an inventory of the basic features of the trail system was to be completed. And, third, the cartographic data would be prepared for transfer to DWGNRA's Geographic Information System (GIS). Using the Corps' maps (1:400 scale) as a baseline, two surveyors were directed to hike all roads and trails appearing on the maps, confirm the existence and location of these features, and accurately locate any roads or trails not appearing on the maps. While hiking the system, the inventoried roads and trails were categorized according to NPS management classifications, access, ownership, surface, average width, and maintenance level. Scenic features, water courses, major maintenance needs, and vehicle barriers also were noted on the maps.

### Trail System Inventory: Applications

The trail system inventory painted a broad overview of the entire system of roads and trails found in DWGNRA. From this baseline information, a preliminary trail system was selected during a consultation period involving NPS and AMC staff. This period of *intermediate evaluation* was built into the field schedule of the project. The prescriptive work log technique for assessing trails was applied to the trails comprising this preliminary system.

The GIS applications of the inventory data are perhaps the most beneficial. Access to high quality maps during the trail planning review process will encourage constructive criticism of the preliminary trail system's layout. Not all roads and trails inventoried in DWGNRA were selected for the proposed system. Only those that appealed to the perceived visitation demands and the indicated management objectives were selected. However, access to an accurate set of trail resource maps will better communicate the AMC's rationale for recommending the particular system found in their report. Also, computer generated maps will likely facilitate interpretive efforts, maintenance efforts, resource protection efforts, and resource management efforts, as well as search and rescue, and fire fighting operations.

A well formulated trail system inventory should remain applicable for many years. However, a new inventory of specific trails or areas, possibly with new parameters, may be necessary following the onset of natural disasters (extensive flooding or heavy snow-melt), introduction of a new form of recreation (mountain bike or horse use), or inauguration of new management directives (management zoning).

#### Prescriptive Work Logs: Methodology

Various forms of prescriptive work logs have been applied by agencies and organizations in diffuse regions of the country. Hooper (1988) describes a trail log format employed by the NPS, though this particular approach is considered to be a physical inventory separate from what Hooper refers to as a condition/ corrective survey. Prescriptive work logs have traditionally blended a detailed physical inventory with a series of corrective prescriptions intended to remedy any trail tread and alignment deficiencies observed along a trail. The AMC Trails Program has applied such assessments extensively for some fifteen to twenty years. Proudman and Rajala (1981) describe several methods for conducting prescriptive work logs. Recent incorporation of the capabilities of personal computer technology to store, analyze, and present information has made the prescriptive work log format even more useful than in the past.

For a prescriptive work log to be a reasonable estimate of a trail's condition, the individual conducting the survey must be accomplished in trail construction and design. Prescriptive work logs completed in the DWGNRA were compiled by an

individual proficient with a wide range of trail work techniques and the many options for mitigating trail resource damage. In general, prescriptions for trail work actions should be the minimal necessary to stabilize the trail tread, should emphasize protection of natural resources, and should exhibit a clear understanding of the trail's role within the locally available recreational opportunities. Further, those who are compiling the surveys should be given clear understanding and directions regarding the intentions for the trail.

In DWGNRA, a format for prescriptive work logs was selected that relied upon pocket dictation device to record comments. These comments were organized by verbal reference to distances indicated by a five foot circumference trail-measuring wheel pushed along each trail. The wheel's counter displayed the distance from a starting point within six (6) inches by tallying five foot intervals to the nearest tenth of an interval. The location of permanent reference features such as stream crossings or conspicuous rocks was noted to facilitate accurate future location of sites requiring work.

The dictation notes were later transcribed and formatted on a computer word-processor. A standard format has evolved at the AMC (Example 1.). The work logs can then be printed and placed in a ring-binder for simple access. A well-documented prescriptive work log done in the Northeast will remain a good gauge of a trail's condition for roughly five to ten years, depending on the amount of recreation use, the form of that recreation, and any severe weather.

Example 1. Format of an AMC Prescriptive Work Log.

| Project Title (if appropriate)   |  |   |
|--|--|---|
| Trail: ADAM'S CREEK TRAIL  |  |   |
| file name: "ADAMCRKLOG"  |  |   |
| pages: 12  |  |   |
| Area: West of Rt. 209, north of Dingman's.   |  |   |
| Date: Aug. 26, 1989  |  |   |
| Synopsis: Containing a summary of the work log's highlights. Appropriate comments include trailhead information (sings, parking, access, etc.), safety concerns, natural features, basic geology (helpful for work crews), and major issues or problems associated with the trail. |  |   |
| <u>1=5 ft</u>  | <u>Comments</u>  | <u>Work</u>   |
| 006  | [EX: information that a work crew would use to orient themselves or to find a work site, suggestions for installing the work, or dimensions of existing trail work.] | 6' Water Bar, Right; install 20" ditch parallel to tread [in gully adjacent to road]. |
| 012  | ref. trail traverses section of old road w/ stone wall, Left; terrain drops off down to creek, Right; no work needed.  |   |
| 173  | ref. remains of old jeep road joins from Left; 2 large red pines on ground   | Install 5 Rock Steps to harden 3-foot-deep gully.                                     |

The dictation method of recording prescriptive work logs has advantages and disadvantages. Occasional errors in handling the tape recordings do occur, and clear enunciation of concise comments is imperative. Furthermore, the dictation tapes must be transcribed, introducing another potential source of error. However, compared to the alternative of recording comments on paper forms, dictation devices have several advantages. The devices are more efficient in the field since they require only one hand to operate, as compared to taking notes on a clipboard. Further, notes on paper are more time-consuming to write and there is a tendency to be too brief. If a prescriptive work log is to be used as a document in a trail work labor contract, or is to be used by a field crew who is unfamiliar with an area, detailed descriptions of work locations are very important. Finally, dictation devices work well in plastic bags under wet conditions, allowing assessment of trail

drainage problems at times when those problems are most obvious.

#### Prescriptive Work Logs: Applications

By following standardized procedures for recording comments, managers and their staff can assemble information in a format that facilitates field efforts and trail work planning. Managers concerned with allocating budgets and staff, and staff concerned with completing field projects, benefit from the information in prescriptive work logs, originally developed for specifically these purposes. In DWGNRA prescriptive work logs facilitated planning efforts by providing information about the proposed trail system's strengths and limitations. Prescriptive work log trail maintenance assessment figures for each trail were entered into a computer database and printed in a catalog format (Example 2). A database also permits managers to calculate labor and materials

necessary to complete the estimated work needed on a trail. Data from the prescriptive work logs completed in DWGNRA can effectively summarize the trail maintenance work required

for a single trail or any selected grouping of trails. Additionally, prescriptive work logs are commonly used as a field guide for trail work contractors and cooperators.

Example 2. Format of an AMC Catalog Entry of Prescriptive Work Log Summary.

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**Project Title (if appropriate)**

Trail Name: Adam's Creek  
 Length: 0.93 mi.  
 Date of Log: Aug. 26, 1989  
 Logged By: Name

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| <p><u>General Characteristics</u></p> <p>Difficulty: moderate<br/>       Existing use: Hiking<br/>       Level of use: moderate<br/>       Recommended use: Hiking<br/>       Expected level of Maintenance: moderate<br/>       Sensitive areas?: Yes<br/>       Potential safety concerns?: Yes</p> | <p><u>Maintenance Figures</u></p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Item</th> <th style="text-align: left;">Total Feet</th> <th style="text-align: left;">Units</th> </tr> </thead> <tbody> <tr> <td>Rock Steps</td> <td>n/a</td> <td>43</td> </tr> <tr> <td>Log Steps</td> <td>n/a</td> <td>0</td> </tr> <tr> <td>Step Stones</td> <td>n/a</td> <td>32</td> </tr> <tr> <td>Ditching</td> <td>6</td> <td>1</td> </tr> <tr> <td>Wood Water Bar</td> <td>16</td> <td>2</td> </tr> <tr> <td>Rock Water Bar</td> <td>0</td> <td>0</td> </tr> <tr> <td>Cribbing</td> <td>75</td> <td>1</td> </tr> <tr> <td>Stream Bridge</td> <td>0</td> <td>0</td> </tr> <tr> <td>Bog Bridge</td> <td>0</td> <td>0</td> </tr> <tr> <td>Sidehilling</td> <td>0</td> <td>n/a</td> </tr> </tbody> </table> | Item  | Total Feet | Units | Rock Steps | n/a | 43 | Log Steps | n/a | 0 | Step Stones | n/a | 32 | Ditching | 6 | 1 | Wood Water Bar | 16 | 2 | Rock Water Bar | 0 | 0 | Cribbing | 75 | 1 | Stream Bridge | 0 | 0 | Bog Bridge | 0 | 0 | Sidehilling | 0 | n/a |
|---|--|-------|------------|-------|------------|-----|----|-----------|-----|---|-------------|-----|----|----------|---|---|----------------|----|---|----------------|---|---|----------|----|---|---------------|---|---|------------|---|---|-------------|---|-----|
| Item  | Total Feet   | Units |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Rock Steps  | n/a  | 43    |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Log Steps   | n/a  | 0     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Step Stones   | n/a  | 32    |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Ditching  | 6  | 1     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Wood Water Bar  | 16   | 2     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Rock Water Bar  | 0  | 0     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Cribbing  | 75   | 1     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Stream Bridge   | 0  | 0     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Bog Bridge  | 0  | 0     |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |
| Sidehilling   | 0  | n/a   |            |       |            |     |    |           |     |   |             |     |    |          |   |   |                |    |   |                |   |   |          |    |   |               |   |   |            |   |   |             |   |     |

Comment:  
 Adam's Creek has several stream crossings. The streams are shallow, except in flood. Step-stones are needed to traverse somewhat deeper sections. Beyond the upper falls is a mill. A number of options are present for connecting the current trail with the mill area if this is desired. Additional route-finding work will be necessary to determine the preferred route. The south bank is recommended for accessing the mill. The north bank is steep and has more obstacles. Management decisions concerning use, type of use, local loop hikes, etc. should be made prior to the installation of this route.

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## Discussion

Trail inventories and prescriptive trail work logs offer managers a standardized, yet flexible, method for inventorying and assessing individual trails or entire trail systems. A consistent methodology for compiling information about trails enhances the capacity of an agency or other organization to manage those trail resources. This paper illustrates the application of two separate but complementary trail surveys which provided information vital to the DWGNRA comprehensive trail system planning process. The trail survey information formed the basis for AMC recommendations regarding the proposed DWGNRA trails system, including the type, extent, and cost estimates of the trail work required to fully establish the proposed system.

Trail surveys provide objective information about trail resource conditions and the capabilities of the trail resource to sustain various forms of recreation. Such information should be integrated with expressed public needs and views when formulating a final trail system plan. It is recommended that the results provided by trail surveys be presented to the public as background information supporting public involvement and review. Such input is viewed as critical to the design and implementation of a broadly accepted network of trails appealing to recreationists of all interests, whether hikers, walkers, horse-riders, or bicyclers.

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